December 12, 1844.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"On the Laws of the Tides on the Coast of Ireland, as inferred from an extensive series of observations made in connexion with the Ordnance Survey of Ireland." By George Biddell Airy, Esq., F.R.S., Astronomer Royal.

The elaborate investigations of which the results are communicated in the present paper, were suggested by the necessity of adopting some standard mean height of the sea, as a line of reference for the elevations ascertained in the operations of the Ordnance Survey of Ireland. Colonel Colby, R.E, who conducted that survey, had with this view determined to institute a series of observations on the height of the water in different states of the tide; and conceiving that these observations might be made subservient to improvement in the theory of the tides, requested the assistance of the author in laying down the plan of observation best calculated to effect that object. The suggestions which were, in consequence, made by the author were adopted in their utmost extent by Colonel Colby; and the collection of observations was placed in the author's hands in the winter of 1842. The whole number of observations exceeds two hundred thousand; and they derive extraordinary value from the circumstance of the localities, of their simultaneity, their extensive range, and the uniformity of plan on which they were conducted. Their reduction was made by the computers at the Royal Observatory, Greenwich, under the superintendence of the author, and with the authority of the Lords Commissioners of the Treasury. The nature of the different branches of the inquiry may be gathered from the titles of the several sections into which the paper is divided, and which are as follows:—

Section I.—Account of the stations, levellings, times and methods of observation.

Section II.—Methods of extracting from the observations the times of high and low water; of supplying deficient times and heights; and of correcting the times first determined.

Section III.—Theory of diurnal tide as related to observations only; and deduction of the principal results for diurnal tide given immediately by these observations.

Section IV.—Theory of diurnal tide as referred to the actions of the sun and moon.

Section V.—Discussion of the height of apparent mean water, as deduced from the heights of high and low water only, corrected for diurnal tide; with reference to difference of station, and to variations of the phase of the moon, and of the declination of the moon.

Section VI.—Discussion of the range of the tide, and of semimenstrual inequality in height, apparent proportion of solar and lunar effects as shown by heights, and age of tide as shown by heights, from high water and from low water.

Section VII.—Establishment of each port, and progress of semidiurnal tide round the island.

Section VIII.—Semimenstrual inequality in time, proportion of solar and lunar effects as shown by times, and apparent age of tide as shown by times, from high water and from low water.

Section IX.—Formation of the time of diurnal high water; progress of the diurnal tide-wave round the island; comparison of its progress and range with those of the semidiurnal tide.

Section X.—Method of expressing the height of the water throughout every individual tide, by sines and cosines of arcs; and expressions in this form for every tide in the whole series of observations, except those at Courtown.

Section XI.—Discussion of the height of mean water deduced from the analysis of individual tides; with reference to difference of station, and to variations of the phase of the moon, and of the declination of the moon.

Section XII.—Discussion of range of tide, or coefficient of first arc, in the analysis of individual tides; and of semimenstrual inequality in range, apparent proportion of solar and lunar effects, and age of tide as deduced from range.

Section XIII.—Establishment of each port, as deduced from the time of maximum of the first periodical term in the analysis of individual tides.

Section XIV.—Semimenstrual inequality in time, proportion of solar and lunar effects from times, and apparent age of tide as shown by times, deduced from the time of maximum of the first periodical term.

Section XV.—Comparison of the results as to mean height, range, semimenstrual inequality in height, age of tide obtained from height, establishment, semimenstrual inequality in time, and age of tide obtained from time, deduced from high and low waters only, in Sections V., VI., VII., VIII., with those deduced from the analysis of individual tides in Sections XI., XII., XIII., XIV.

Section XVI.—Remarks on the succeeding terms of the expressions for individual tides, as related to the magnitude of the tide, to the position on the sea-coast, to the position on the river, &c.; comparison with the terms given by the theory of waves; discussion of the quarto-diurnal tides.

Section XVII.—Separate discussion of the tidal observations at Courtown.

Section XVIII.—Examination into the question of tertio-diurnal tide.

January 16, 1845.

SIR JAMES CLARK ROSS, V.P., in the Chair.

"On the Liquefaction and Solidification of Bodies generally existing as Gases." By Michael Faraday, Esq., F.R.S., D.C.L., &c.

The method employed by the author for examining the capability of gases to assume the liquid or solid form, consisted in combining the condensing powers of mechanical compression with that of very